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# **EUROPEAN PATENT APPLICATION**

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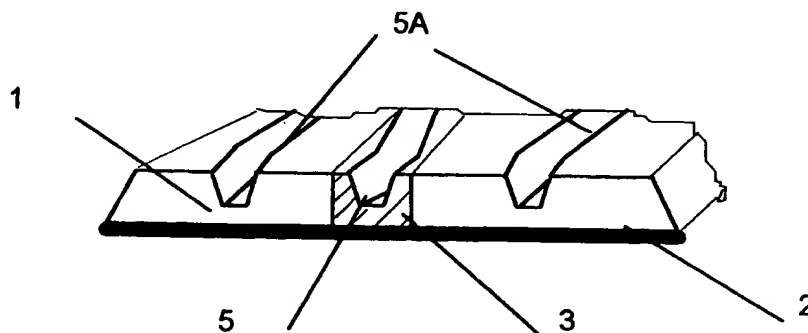
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(54) Tyre treads and tyres incorporating them.

(57) A tyre tread comprising an elongated strip of tyre tread compound of high resistivity having a transverse width (TR) characterised by within the transverse width (TR) a longitudinally extending conducting strip (3,6,7) of low resistivity tyre compound with a volume resistivity less than  $10^8$  ohm cm said conducting strip extending from the top to the bottom surface of the tread strip.



**Fig. 2**

**EP 0 681 931 A1**

This invention relates to tyre treads and in particular to tyre treads which are electrically conducting including those reinforced by Silica.

The build-up of static electric charge in moving vehicles can have a potentially adverse effect on electronic circuitry and radio reception, as well as being a safety hazard should spark discharge occur during re-fuelling. Personal discomfort also occurs if charge is earthed through a driver or passenger.

Charge is normally conducted to earth through the tyres, which requires that the tyres themselves have an acceptable level of conductivity - commonly described as anti-static. Such levels of conductivity are normally guaranteed by the use of tyre compounds containing significant proportions of carbon black as reinforcing filler. Carbon black reduces the resistivity of the intrinsically non-conductive rubber and so provides a leakage path for the static charge from the vehicle to earth.

Anti-static rubber compounds generally require a volume resistivity below  $10^8$  ohm cm, which is usually achievable with approx 50phr or more carbon black in the compound. Such loadings are typical of carbon black-reinforced tyres, which are accordingly anti-static.

If non-black fillers (e.g. silica) are used, or if the carbon black loading is significantly less than 50phr, anti-static properties are often not achieved. For example, with silica filler in place of carbon black, the volume resistivity is typically  $10^{13}$  ohm cm. Should such a compound be used in the tread of a tyre, for example to achieve a lower rolling resistance, the vehicle will effectively be insulated from the road and static charge will not be able to leak to earth.

It is known that electrical conductivity may be improved by the addition of polar ingredients but the effect is generally of insufficient magnitude. Likewise special grades of superconductive carbon blacks may be added but these need to be present in moderately high loadings, e.g. 10-30phr, to be significantly effective, and since their other properties are not suited to tyre applications, road performance may deteriorate.

According to one aspect of the present invention a tyre tread comprises an elongated strip of tyre tread compound of high resistivity having a transverse width (TR) and, within the transverse width (TR) a longitudinally extending conducting strip of low resistivity tyre compound with a volume resistivity less than  $10^8$  ohm cm said conducting strip extending from the top to the bottom surface of the tread strip.

By high resistivity is meant tyre tread compounds having a volume resistivity greater than  $10^8$  ohm cm. Such compounds include for example tyre tread compounds having a silica filler in place of carbon black of which the volume of resistivity is typically  $10^{13}$  ohm-cm.

Preferably the conducting strip is positioned at the centre of the tyre tread strip.

Two or more longitudinally extending conducting strips may be provided and when two strips are used they may conveniently be the tread strip wing component which in the finished tyre form the tyre tread shoulders. This construction is particularly convenient because the tyre tread wings are usually extruded of a different material to the main part of the tyre tread strip and thus no additional extruded component is necessary.

The width of the conducting strip is preferably in the range of 5-25% of the width of the tyre tread TR.

The compound of the conducting strip more preferably has a volume resistivity of less than  $10^6$  ohm cm.

Another aspect of the invention provides a tyre comprising a tyre tread strip according to any of the above claimed features. Preferably the width of the conducting strip is greater than the width of the widest longitudinally extending tread groove to ensure that the conducting strip may contact the road when the tyre is completed and used on a vehicle.

Further aspects of the present invention will become apparent from the following description, by way of example only, of two embodiments in conjunction with the attached diagrammatic drawings in which:

Figure 1 is a transverse cross-sectional view of an extruded tyre tread strip according to the present invention;

Figure 2 shows the tyre tread strip of Figure 1 after tyre manufacture; and

Figure 3 shows an alternative tyre tread strip.

Figure 1 shows the transverse cross-section of a longitudinally extended tyre tread strip comprising a main tyre tread compound region 1 and a tyre sub-tread region 2. This assembly is the standard one where an extruded tread compound strip of the required cross-section is brought into close contact with a flat strip or sheet of sub-tread compound to form a sub-assembly on later tyre manufacture.

In this case however the first or main tyre tread strip region 1 is in three parts. Firstly a centre part 3 having a width of 15% of the tyre strip width TR and two main side regions 4. The centre region comprises a rubber compound having a volume resistivity of approximately  $10^8$  ohm-cm being reinforced by carbon black and having the following formulation.

	SBR 1712, styrene 23.5%, oil 27.3%	96
5	BR, 96% 1,4-cls	30
	N234 Carbon Black	80
	Silica Ultrasil VN3	-
	*TESPT/N330 1:1 (X50-S)	-
10	Zinc Oxide	3
	Stearic acid	2
	Aromatic oil	10
15	CBS	1.5
	DPG	-
	Sulfur	1.5
20	*bis [3-triethoxysilylpropyl] tetrasulfane/N330 1:1 blend marketed by Degussa as X-50S.	

25 The side regions 4 are of a rubber compound reinforced by silica having a volume of resistivity approximately  $10^{13}$  ohm-cm. The formulation of the side region tread compound is as follows.

30	SBR 1712, styrene 23.5%, oil 27.3%	96
	BR, 96% 1,4-cls	30
	N234 Carbon Black	-
	Silica Ultrasil VN3	80
35	*TESPT/N330 1:1 (X50-S)	12.8
	Zinc Oxide	3
	Stearic acid	2
40	Aromatic oil	10
	CBS	1.5
	DPG	2
45	Sulfur	1.5
50	*bis [3-triethoxysilylpropyl] tetrasulfane/N330 1:1 blend marketed by Degussa as X-50S.	

55 The tyre tread strip is fitted to tyre a carcass on top of a tread reinforcing breaker in the normal way and the tyre is vulcanised in a tyre curing press where the tyre tread pattern is formed. Figure 2 shows a short section of the tyre tread strip after such vulcanisation in a tyre mould and for simplicity is showing the three longitudinally extending zig-zag grooves as the tyre tread pattern. As can be seen the central region 3 having low resistivity has a large centre groove 5 formed therein but the width of the centre region 3 is such that there is still low resistivity compound at the tyre road contacting surface and the low resistivity material extends to the sub-tread 5 providing a path for charge to dissipate from the tyre to the road. The two side main grooves

5A do not have this low resistivity material but are formed in the silica, comparatively high resistivity, material.

In the embodiment shown in Figure 3 the high resistivity silica compound forms the main region 1 of the tyre tread strip. Once again a sub-tread 2 is provided but in this case the wing portions 6 and 7 of the tyre tread strip comprise the low resistivity materials. Similar compounds to the previous one may be used for this

In a further modification to the constructions embodied in Figures 1, 2 and 3, the sub-tread component (region 2) may be omitted.

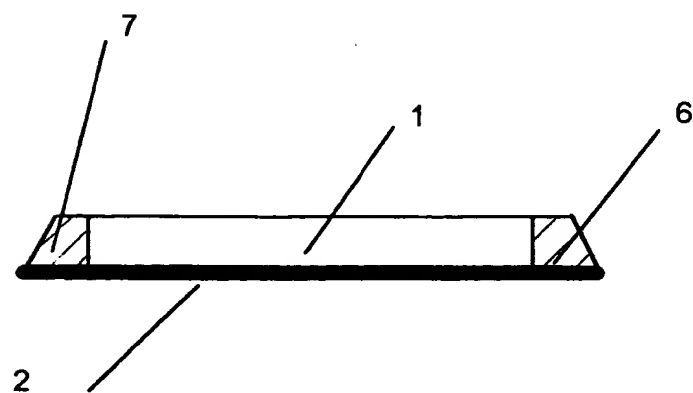
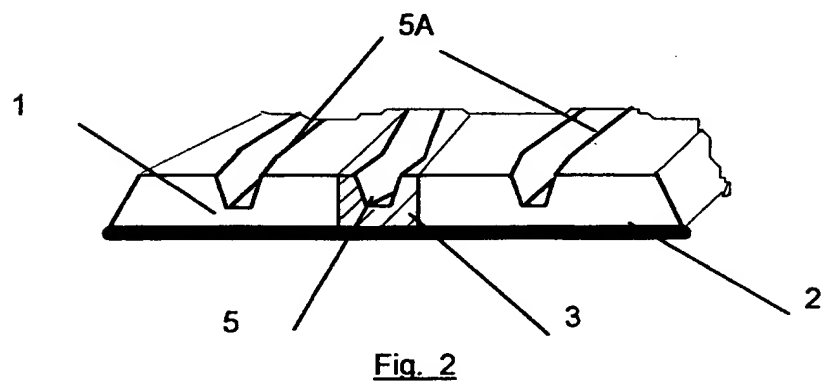
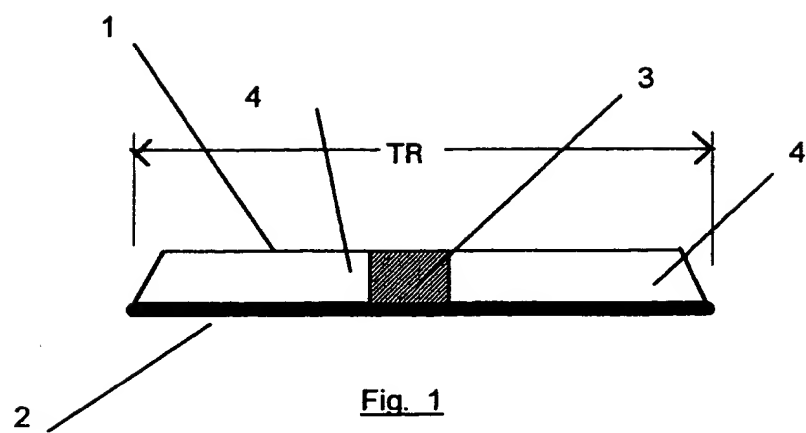
The formulation for the conducting or low volume resistivity components is given purely by way of example only and any of the normal low resistivity formulations known in the art may be used. Likewise the formulation of the non-conducting or high volume resistivity component is given purely by way of example only and any of the high resistivity formulations known in the art may be used.

In the resultant tyre the properties of the silica reinforced tyre exist in full measure giving wear, wet grip, ice grip etc according to the silica compound formulation chosen. The disadvantage of silica compounds however in having too high a volume resistivity whereby static charge may be maintained on the vehicle so causing the problems mentioned above is overcome by the conducting paths of the low volume resistivity material provided in the tyre tread strip.

A most important advantage of the construction of the present invention however is that the strips of low resistivity material comprise extrudable sections and the tyre tread strip can be manufactured using conventional extrusion techniques bringing the various components together to form a handleable tyre tread strip. The tyre tread strip may be spooled and used in continuous lengths or cut to the required length for each tyre to be manufactured.

## Claims

1. A tyre tread comprising an elongated strip of tyre tread compound of high resistivity having a transverse width (TR) characterised by within the transverse width (TR) a longitudinally extending conducting strip (3,6,7) of low resistivity tyre compound with a volume resistivity less than  $10^8$  ohm cm said conducting strip extending from the top to the bottom surface of the tread strip.
2. A tyre tread according to claim 1, characterised in that the conducting strip (3) is substantially at the centre of the tread strip.
3. A tyre tread strip according to claim 1, characterised in that two conducting strips (6,7) are provided, each extending longitudinally in the tyre tread.
4. A tyre tread according to claim 3, characterised in that the two conducting strips (6,7) are the tread wings which form the tyre tread shoulders after tyre manufacture.
5. A tyre tread according to any of claims 1 to 4, characterised in that the width of the or each conducting strip is in the range of 5 to 25% of the width of the tyre tread.
6. A tyre tread according to any of claims 1 to 5, characterised in that the volume resistivity of the compound of the conducting strip is less than  $10^6$  ohm cm.
7. A tyre tread according to any of claims 1 to 6, characterised in that the high resistivity compound comprises silica as the major reinforcement or filler material.
8. A tyre characterised by a tyre tread strip according to any of claims 1 to 7.
9. A tyre according to claim 8, characterised in that the conducting strip has a width greater than the width of the widest longitudinally extending tread groove.





European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 95 30 3175

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. CL.6)
E	EP-A-0 658 452 (PIRELLI S.P.A.) * claims; figures *	1-9	B60C19/08
X	GB-A-551 657 (THE FIRESTONE TIRE&RUBBER CO.) * claims; figures *	1,6,8	
X	DE-C-820 543 (CONTINENTAL) * claims; figure *	1,3,4	
A	GB-A-544 757 (THE U.S. RUBBER CO.) * page 4, line 62 - line 81; claims; figures *	1-9	
A	CH-A-597 008 (AESCHMANN) * column 2, line 8 - line 42 *	1	
A	DATABASE WPI Week 9118 Derwent Publications Ltd., London, GB; AN 91-128812 & JP-A-03 067 705 (BRIDGESTONE CORP.) , 22 March 1991 * abstract *	1,7	
A	PATENT ABSTRACTS OF JAPAN vol. 10 no. 342 (M-536) ,19 November 1986 & JP-A-61 143203 (YOKOHAMA RUBBER CO. LTD.) 30 June 1986, * abstract *	1	TECHNICAL FIELDS SEARCHED (Int. CL.6)
			B60C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 29 August 1995	Examiner Baradat, J-L
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure F : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons</p> <p>A : member of the same patent family, corresponding document</p>			

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